

CLAIMS:

1. A method for modulating flowering in a plant, comprising modifying in said plant the endogenous level of at least one compound selected from the group consisting of jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, sulfate ester of 12-hydroxyjasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, sulfate ester of 12-hydroxymethyljasmonic acid, 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, sulfate ester of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, glucoside of 11-hydroxymethyljasmonic acid, sulfate ester of 11-hydroxymethyljasmonic acid, and mixtures thereof.
2. The method of claim 1, wherein flowering of said plant is induced by increasing in said plant the endogenous level of at least one flowering inducing compound selected from the group consisting of jasmonic acid, jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, methyljasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, and glucoside of 11-hydroxymethyljasmonic acid, said flowering induction and said endogenous level increase being compared to a corresponding plant wherein the endogenous level of said at least one compound has not been modified.
3. The method of claim 2, wherein the endogenous level of said at least one flowering inducing compound is increased by a method selected from the group consisting of:

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- a) applying to said plant at least one of said flowering inducing compounds and/or salts thereof;
 - b) applying to said plant at least one inhibitor of a sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic; and
 - 5 c) applying to said plant at least one stimulator of an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid.
4. The method of claim 2, wherein the endogenous level of said at least one flowering inducing compound is increased by:
- 10 a) increasing in said plant the endogenous level of an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid; and/or
 - b) lowering in said plant the endogenous level of a sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic.
- 15 5. The method of claim 4, wherein the endogenous level of the sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic is lowered subsequently to a genetic modification of said plant.
6. The method of claim 5, wherein said genetic modification comprises the
- 20 step of inhibiting the expression of at least one gene selected from the group consisting of *AtST2a*, *AtST2b* and functional homologues of *AtST2a* or of *AtST2b*.
7. The method of claim 6, wherein said gene expression is inhibited by
- 25 expressing into said plant an exogenous sequence coding for a nucleic acid sequence antisense to said gene.
8. The method of claim 7, wherein said exogenous sequence is expressed under the control of a constitutive or an inducible promoter.
9. The method of any one of claims 5 to 8, wherein said plant is transgenic.

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10. The method of claim 3, wherein said plant has been genetically modified to flower early prior application thereto of said flowering compound(s), said sulfotransferase inhibitor(s) and/or said hydroxylase stimulator(s).

5 ~~11.~~ The method of any one of claims 2 to 10, wherein said plant is selected from crop plants.

10 12. A plant genetically modified to flower early when compared to a corresponding plant not genetically modified, said genetically modified plant having an increased endogenous level of jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 15 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, and glucoside of 11-hydroxymethyljasmonic acid, when compared to said corresponding non-genetically modified plant.

13. The plant of claim 12, wherein said genetic modification comprises:

- 20 a) increasing in said genetically modified plant the endogenous level an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid; and/or
b) lowering in said genetically modified plant the endogenous level of a sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic.

25 ~~14.~~ The genetically modified plant of claim 12 or 13, wherein said genetic modification comprises inhibiting the expression of at least one gene selected from the group consisting of AtST2a, AtST2b and functional homologues of AtST2a or of AtST2b.

30 15. The genetically modified plant of claim 13, wherein the endogenous level of the sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-

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hydroxyjasmonic is lowered by expressing into said plant an exogenous nucleic acid sequence, said exogenous nucleic acid sequence encoding: i) for a nucleic acid sequence antisense to a gene encoding at least one of said sulfotransferases; or ii) for a nucleic acid sequence antisense to a portion of said gene.

16. The genetically modified plant of claim 15, wherein said exogenous sequence is expressed under the control of a constitutive or inducible promoter.

10 ~~17. The genetically modified plant of any one of claims 12 to 16, wherein said~~
~~sub~~ ~~plant is transgenic.~~
~~are~~

18. A cut flower from the genetically modified plant of any one of claims 12 to 17.

15 19. A composition for inducing flowering in a plant comprising a flowering inducing effective amount of a compound selected from the group consisting of, jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, 20 glucoside of 12-hydroxyjasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, glucoside of 11-hydroxymethyljasmonic acid, salts thereof, and mixtures thereof, in combination 25 with a diluent or a carrier such that an induction in flowering of said plant occurs when compared to a corresponding plant in the absence of said composition.

30 20. The composition of claim 19, further comprising a compound selected from the group consisting of fertilizers, growth regulators, fungicides, insecticides, emulsifying agents and mixtures thereof.

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21. The method of claim 1, wherein flowering of said plant is delayed by lowering in said plant the endogenous level of at least one compound selected from the group consisting of jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, and glucoside of 12-hydroxymethyljasmonic acid, said flowering delay and said lower endogenous level being compared to a corresponding plant wherein the endogenous level of said at least one compound has not been modified.

22. The method of claim 21, wherein the endogenous level of said at least one compound is lowered by:

- a) applying to said plant an inhibitor and/or an inactivator of at least one of said compounds;
- b) applying to said plant at least one stimulator of a sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic; and/or
- c) applying to said plant at least one inhibitor of an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid.

23. The method of claim 21, wherein the endogenous level of said at least one compound is lowered by:

- a) lowering in said plant the endogenous level of an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid; and/or
- b) increasing in said plant the endogenous level of a sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic acid.

24. The method of claim 23, wherein the endogenous level of said sulfotransferase is increased subsequently to a genetic modification in the genome of said plant.

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25. The method of claim 24, wherein said genetic modification comprises the steps of increasing the expression of at least one gene selected from the group consisting of *AtST2a*, *AtST2b* and functional homologues of *AtST2a* or of *AtST2b*.

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26. The method of claim 25, wherein said gene expression is increased by placing said gene under the control of a constitutive or of an inducible promoter.

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27. The method of any one of claims 21 to 26, wherein said plant is transgenic.

28. The method of claim 22, wherein said plant has been genetically modified to flower lately prior application thereto of said compound(s), said sulfotransferase stimulator(s) and/or said hydroxylase inhibitor(s).

- 15 29. A plant genetically modified to flower tardily when compared to a corresponding plant not genetically modified, said genetically modified plant having a lowered endogenous level of at least one compound selected from the group consisting of jasmonic acid, jasmonic acid-tyrosine conjugate, jasmonic acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, methyljasmonic acid, 12-hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 11-hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-hydroxymethyljasmonic acid, and glucoside of 11-hydroxymethyljasmonic acid, when compared to said corresponding non-genetically modified plant.
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30. The plant of claim 29, wherein said genetic modification comprises:

- a) lowering in said genetically modified plant the endogenous level of an hydroxylase hydroxylating jasmonic acid and/or methyljasmonic acid; and/or
 - b) increasing in said genetically modified plant the endogenous level a
- 5 sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-hydroxyjasmonic.

31. The genetically modified plant of claims 29 or 30, wherein said genetic
modification comprises increasing the expression of at least one gene selected
10 from the group consisting of *AtST2a*, *AtST2b* and functional homologues of
AtST2a or *AtST2b*.

32. The genetically modified plant of claim 30, wherein the endogenous level of
the sulfotransferase sulfonating 12-hydroxyjasmonic acid and/or 11-
15 hydroxyjasmonic is increased by expressing into said genetically modified plant a
nucleic acid sequence encoding said sulfotransferase under the control of a
constitutive or an inducible promoter.

33. The genetically modified plant of any one of claims 29 to 32, wherein said
20 plant is transgenic.

34. A composition for delaying flowering in a plant comprising a flowering
delaying effective amount of an inhibitor or of an inactivator of a compound
selected from the group consisting of jasmonic acid-tyrosine conjugate, jasmonic
25 acid-tryptophan conjugate, jasmonic acid-phenylalanine conjugate, jasmonic acid-
isoleucine conjugate, jasmonic acid-leucine conjugate, jasmonic acid-valine
conjugate, 12-hydroxyjasmonic acid, glucoside of 12-hydroxyjasmonic acid, 12-
hydroxymethyljasmonic acid, glucoside of 12-hydroxymethyljasmonic acid, 11-
hydroxyjasmonic acid, glucoside of 11-hydroxyjasmonic acid, 11-
30 hydroxymethyljasmonic acid, and glucoside of 11-hydroxymethyljasmonic acid, in
combination with a diluent or a carrier such that a delay in flowering of said plant

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43. A method for producing a transgenic plant capable to flower early, said method comprising the steps of:

- 5 a) introducing into a cell of a suitable plant an exogenous nucleic acid molecule comprising a sequence of nucleotides antisense to a sequence encoding a plant hydroxyjasmonic acid sulfotransferase;
- b) regenerating a transgenic plant from the cell; and
- c) growing said transgenic plant for a time and under conditions sufficient to inhibit expression of the hydroxyjasmonic acid sulfotransferase.

10 44. The method of claim 43, wherein the exogenous nucleic acid molecule comprises a nucleotide sequence antisense to a nucleotide sequence selected from the group consisting of SEQ ID NO:1, nucleotide sequences having at least 50% similarity with SEQ ID NO:1, SEQ ID NO:2 and nucleotide sequences having

15 at least 50% similarity with SEQ ID NO:2.

45. A method for producing a transgenic plant capable to flower tardily, said method comprising the steps of:

- 20 a) introducing into a cell of a suitable plant an exogenous nucleic acid molecule encoding a plant hydroxyjasmonic acid sulfotransferase;
- b) regenerating a transgenic plant from the cell; and
- c) growing said transgenic plant for a time and under conditions sufficient to permit expression of the nucleic acid sequence into an hydroxyjasmonic acid sulfotransferase.

25 46. The method of claim 45, wherein the exogenous nucleic acid molecule comprises a nucleotide sequence selected from the group consisting of: SEQ ID NO:1, nucleotide sequences having at least 50% similarity with SEQ ID NO:1, SEQ ID NO:2 and nucleotide sequences having at least 50% similarity with SEQ

30 ID NO:2.

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47. The method of any one of claims 43 to 46, wherein the hydroxyjasmonic acid sulfotransferase is a 11- or a 12- hydroxyjasmonic acid sulfotransferase.

48. An isolated or purified polypeptide having the biological activity of a plant 11-hydroxyjasmonic acid or 12-hydroxyjasmonic acid sulfotransferase.

49. The polypeptide of claim 48, encoding a sulfotransferase enzyme selected from the group consisting of:

- a) an enzyme whose amino acid sequence is represented by SEQ ID NO: 3 or SEQ ID NO: 4; and
- b) functional homologues of enzyme a) isolated from a plant, or derived from enzyme a) by substitution, deletion or addition of one or several amino acids in the amino acid sequences defined in a) and having similar biological activity or function(s).

50. An antibody binding with affinity to a polypeptide as defined in claim 48 or

51. The antibody of claim 50 used for delaying flowering in a plant.

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